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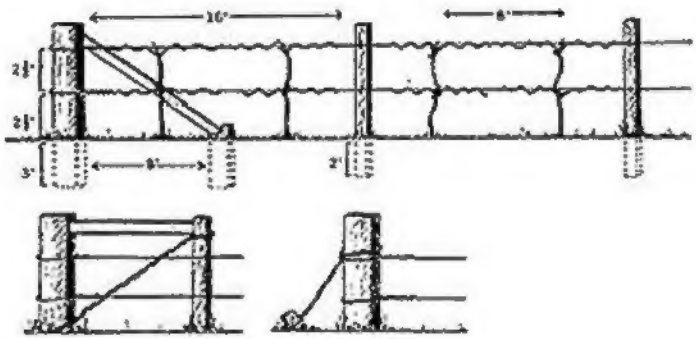
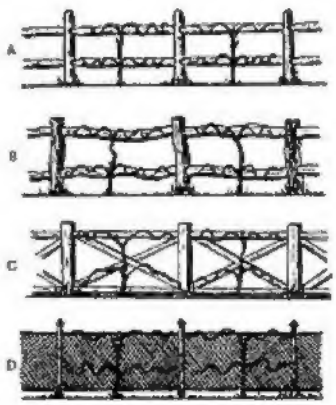


Figure 1
Construction details of two-wire trellis and alternative methods of bracing end posts.

Figure 2
(A) Round poles for cross members. (B) Split rail cross members. (C) Cross members made of 2 x 4s. (D) Chain-link fence (twining of vines and tendrils in fence makes pruning difficult).



Home Fruit Production: Grape Training Systems

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Pruning is one of the most important and most neglected practices in home plantings of grapes. Grapes need some form of support, and pruning (training) is necessary to develop the plant and to maintain it on the support provided. Regular, purposeful pruning is essential for controlling the number, position and vigor of fruiting canes and the yield and quality of the fruit.

Grapes should be pruned during the dormant season, late November to March. Since winter injury of fruiting canes will occur to some extent, late winter pruning generally is preferred. If pruning is delayed until near bud swell, the cuts commonly ooze sap abundantly. Though not desirable, "bleeding" seems to be of minor importance.

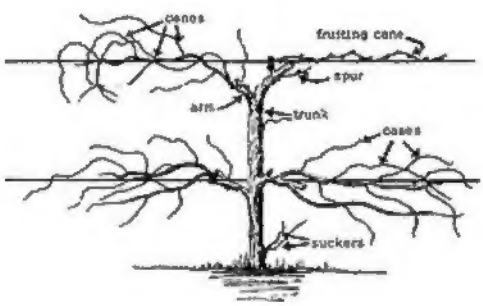


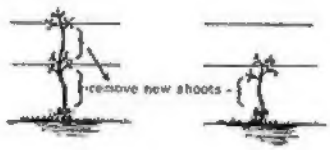
Figure 3
Mature plant shows parts. The upper right portion is pruned to show a spur and fruiting cane.

Pruning at planting time

The best cane usually is selected and shortened to two buds. All other canes are removed.

Sometimes a plant is especially vigorous and has one cane that will reach the lower wire or beyond. In this case, the cane may be cut at the height of the lower wire and tied tautly to it. When new shoots are about 1 inch long, remove them except for the upper two or three near the wire. De-shooting is illustrated in Figure 4. From among the shoots allowed to develop, one will be selected to complete the trunk.

Figure 4
Young plants with new shoots are selected at trellis wires; all others are removed.



Second year

Select the most vigorous cane and remove all others. If the cane is long enough to reach the top wire, cut it off at that height and tie tautly to the wire (Figure 5a). A shorter cane would simply be pruned and tied to the lower wire (Figure 5b). Plants having no canes long enough to reach the lower wire should be pruned as a newly set plant (one cane shortened to two buds, Figure 5c).

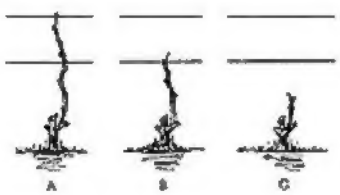


Figure 5
Plants look like this after pruning in second season.

Early in the second growing season, some cane selection for the next year may be possible on the larger, more vigorous plants. When new shoots are 1 to 3 inches long, remove all but three or four arising from near each wire.

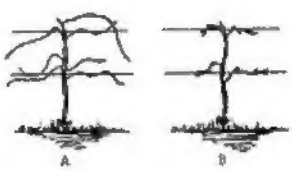
Flower or fruit clusters are best removed as noticed. Plants bearing no fruit make stronger vine growth.

Third year

In the dormant period preceding the third year, the more vigorous plants should consist of a main stem or trunk reaching to one or both trellis wires and having several canes. Considering position and vigor, select two of the best canes at each wire and remove the others. Shorten the selected canes leaving two to four buds on each. See Figure 6.

Plants pruned and tied to the lower wire in the second year may be pruned as in Figure 7.

Figure 6
Plant at beginning of third season -- (a) Unpruned; (b) pruned.



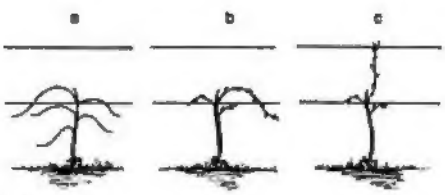


Figure 7
Plant pruned and tied to lower wire in previous year -- (a) unpruned; (b) after pruning; (c) long cane tied to upper wire completing development of trunk.

The two to four buds left on the short canes will give rise to shoots that will bear some fruit. They also will be the source from which to choose next year's fruiting canes.

Fourth year

Beginning in the fourth season, the plant should have two or more canes extending in both directions at each wire. Select a fruiting cane and where possible a renewal spur at each of the four arms. Figure 8 illustrates a typical plant before and after pruning. Note that renewal spurs were chosen from canes nearest the trunk. This is important for maintaining fruiting wood close to the trunk and keeping the whole plant within its allotted space. Where this is not practiced, the fruiting wood develops farther from the plant each year, crowding adjacent plants and weakening growth.

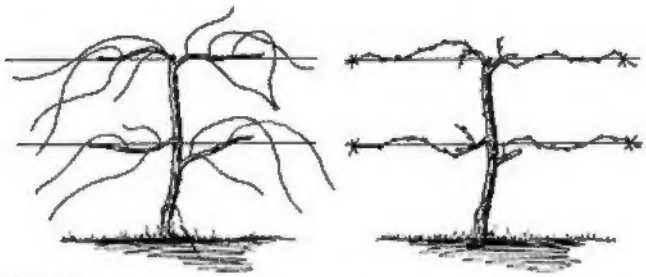


Figure 8
Unpruned plant before fourth season (above) and same plant after pruning and tying (right).

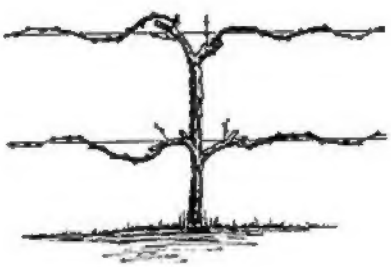
Select the fruiting canes with the following considerations in mind: moderate vigor (diameter and length), reasonably straight, originating near the trunk, and reasonably close to the appropriate trellis wires. All other growth is removed, including any sucker growth arising on the lower trunk. Shorten the selected fruiting canes leaving six to 10 buds. Leave more or fewer buds depending on plant vigor -- 10 to 12 buds on vigorous plants, four to six on weaker plants.

In the following years, pruning will not be greatly different from fourth year pruning. Where a renewal spur was present during the preceding growing season, it is frequently the nearest source from which to select a fruiting cane. Thus, the old arm with numerous canes attached can be removed with one cut made near the trunk. If no renewal spur is present, select a cane elsewhere and if possible, leave a spur for use the following year.

The number of buds left per cane may be increased to about 10 to 12 on plants of good vigor. Again, number of buds left should be adjusted according to plant vigor.

After pruning, the mature plant should appear similar to that shown in Figure 9.

Figure 9
Mature plant after pruning -- compare with Figure 3.



Four-cane Kniffin system

The four-cane Kniffin system is similar to an ordinary two-wire fence. Wooden end posts should be at least 6 inches in diameter and from 8 to 8-1/2 feet long. When set about 3 feet deep and properly braced, the wires can be stretched fairly tight. Other posts may be smaller and need not be set as deeply as end posts. Oak posts treated with a preservative are satisfactory. Steel fence posts may be used except for the end.

The trellis wire should be smooth, galvanized, number 10 or number 11 gauge. Post spacing, wire height and other details are shown in Figure 1.

Figure 2 illustrates using an existing fence or one of ornamental value. This is possible while still retaining the support features of the special two-wire trellis. Solid fences are least desirable. Such fences may obstruct sunlight and interfere with spraying.

Umbrella Kniffin system

This system provides good conditions for producing high quality fruit. The fruit and foliage is held well up on the trellis for good sunlight exposure and air circulation. These conditions aid in reducing diseases. The long fruiting canes used make the system best adapted to vigorous varieties or in situations conducive to vigorous growth.

Early training follows the procedure described previously, and the same two-wire trellis is used.

Develop the trunk to a point near the top trellis wire, removing canes that arise near the lower wire or below. Under average conditions this will require two years, but some plants may reach the top wire in one. In the following growing season, shoots will develop from buds along the upper trunk. The growth of these shoots can be improved by early removal of those which develop below.

In the next dormant season, select two canes (one on each side of the plant) which originate about midway between the two wires. Remove all others. If the plant has made vigorous growth, the canes can be left 10 to 12 buds long. The length should permit bending the cane over the top wire and then down and outward from the trunk to the lower wire. Tie the cane snugly to the lower wire. If the canes are short and small in diameter (weak), shorten the two selected canes to spurs with two to four buds each. These pruning details are in Figure 10.

Figure 10
(a) Vigorous plant showing pruning and positioning of cane. (b) Weaker plant showing method of pruning.

Following this pruning, a moderate crop of fruit and several strong canes should be produced. The most vigorous canes will develop from buds between the trunk and the top wire. This provides good fruiting wood in the desired position for the next year. The remainder of the fruiting cane, being inverted, tends to make less growth and be more fruitful.

Each year thereafter, select three or four of the best canes, cut back two others near the trunk for renewal spurs and remove all others. Bend each fruiting cane individually over the top wire and extend to the lower wire and tie firmly. Cut off any portion of the fruiting cane that extends below the lower wire. The fruiting canes should be spaced along the trellis and not bunched together. See Figure 11.

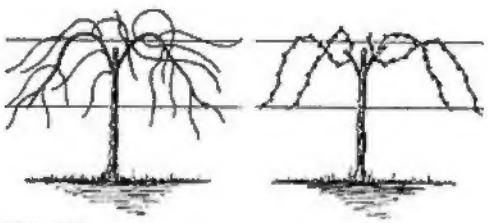


Figure 11
Fully developed plant, unpruned (left) and pruned (right).

Cordon systems

What is being described as cordon system training here goes by a variety of names, including single curtain cordon, bilateral cordon and high cordon, but the basic principles among these specific systems remain constant. This system probably is the one to choose for most Missouri conditions for the following reasons: it allows for excellent light and spray penetration, yields high-quality fruit, is easy to prune and pick, requires little or no tying and provides some frost protection with high wire. On the other hand, the cordon systems are not suitable for winter-tender cultivars, must be combed, can suffer from wind damage, exposes the fruit more to birds and sun, and some cultivars just are not adaptable to it. These systems can work well for homeowners who are having trouble managing the vines on the lower wire in a four-arm Kniffen.

While the trunk is the only permanent above-ground part of the grape plant in the Kniffen systems, the trunk and cordons along the top wire are permanent in the cordon systems. In a bilateral cordon, the plant is trained in both directions along the wire from the trunk, while in the single cordon system, the plant is trained in a single direction. In addition, the cordon systems require only one high wire, although some growers will use a lower wire to help train new vines upward toward the high wire.

The plants are treated similarly to the four-arm Kniffen in years one through three. However, in the third year, the canes you select will become the permanent cordons (Figure 12a). Pruning in years beyond the third year involves selecting spurs that will fruit next year, shortening them and removing all others. In general, on a 3-year-old plant, four to 10 fruiting spurs are left on each cordon, each with one or two buds (Figure 12b). As the plants age, six to 12 fruiting spurs with two to five buds on each spur are selected to remain on each cordon (Figure 12c). Ideally, these

fruiting spurs are spaced 6 inches to 1 foot apart. As with the Kniffen systems, the number of fruiting spurs and buds depends on the vigor of the variety grown; more may be left on vigorous plants and less on weaker plants.

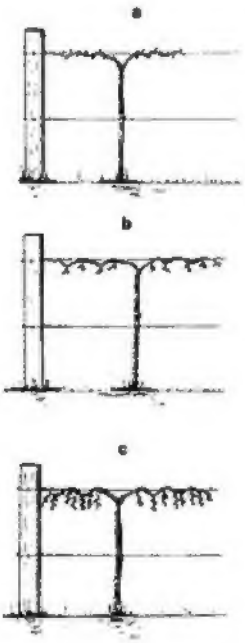


Figure 12
Grapes trained and pruned in a cordon system. In the third year, canes have been selected to be permanent cordons (a) In the following years, fruiting spurs are selected (b) ideally to be eventually spaced 6 inches to 1 foot apart (c) The number of spurs and buds will depend on the plant's vigor.

In cordon systems, the permanent cordons should be periodically renewed, especially if a cordon has been severely injured by low temperatures, insects or diseases. Simply train another well-positioned shoot near where the old cordon arises, grow it for a year, then remove the old cordon the following year.

"Combing" should be done when using the cordon systems. In combing, the shoots that develop from the retained buds are vertically positioned (combed) downward to prevent shoots from growing over one another. If a lower wire is in place, these combed shoots often are tied to the lower wire.

Fan system

This system is useful for training to walls and fences, although a special trellis or arbor could be used. A plant pruned and trained to this system has several upright canes branching from arms on a very short trunk. Since the upright training promotes good growth, weak plants (due to variety of soil conditions) would be well adapted to this system.

Many of the developing shoots droop to the ground forming a more effective screen. A disadvantage is that the fruit developing near the ground will become dirty or possibly decayed.

The newly set plant is pruned to a short two-bud spur. If the plant grows well in the first season, both of the canes (one from each bud) may be left after shortening each to three or four buds. A weaker plant may be left with two spurs of two buds each. At the beginning of the third season, the plant may have four or more good canes. Select three or four of the best for fruiting canes. If others are present in a fairly low position, leave two or three of them as two-bud spurs and remove any others. Shorten the fruiting canes to the height of the trellis and tie them at the tip. Position the canes in a spreading fanlike arrangement. See Figure 13.

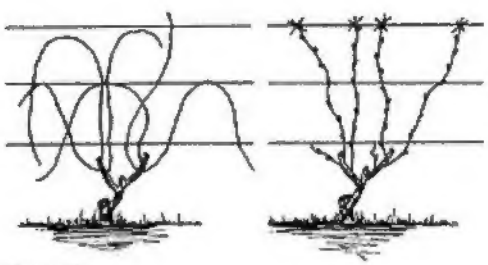


Figure 13
Plant pruned to fan system at beginning of third season.

Some fruit will be produced in the third season

The number of fruiting canes may be increased to six or eight in subsequent years, depending on length of the canes (number of buds) and plant vigor. Select fruiting canes from renewal spurs where possible. Otherwise, select them from near the base of last year's fruiting cane and if possible leave three or four spurs for use the following year.

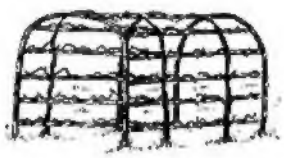


Figure 14
Grapes trained and pruned on an arbor.

Arbors

Many prefer to grow grapes on an arbor, thus combining the benefits of fruit production, shade and ornamental effects. Vines grown on arbors generally produce less low-quality fruit than traditional systems do. Suitable arbors can be in an almost endless number of designs. A more important consideration is that the arbor be constructed of durable materials requiring minimal maintenance.

In general, plants are placed on both sides of an arch-like structure and trained to grow up and over to about mid-point of the top. Providing this amount of foliage cover re-quires a larger and taller plant than is necessary for an ordinary trellis. In this situation there is a tendency to prune too lightly, if at all. Often the end result is a tangled mass of multiple trunks, numerous canes, weak growth and poor fruit production. Training the plants to a single trunk and leaving relatively short horizontal fruiting canes is a suitable method for most situations. See Figure 14.

Develop a portion of the trunk each year by tying an uppermost vigorous cane in a vertical position. At the same time, select fruiting canes at intervals of 2 to 3 feet. These should be limited to five or six buds to favor development of the upper trunk and canes. The selection and use of renewal spurs also is valuable for maintaining a source of fruiting wood close to the trunk.

Single-trunk vs. two-trunk training

Commercial grape growers often will train two parallel trunks in the systems that have just been described. In essence, each trunk makes up for half the canopy. For instance, in the case of the four-arm Kniffen, one trunk might produce the canes for the right side lower wire and the left side upper wire, and vice versa for the other trunk. Growers do this as a hedge against stress, particularly winter damage; if one trunk is killed, production from that plant is not completely lost. Two trunks also allows for renewing a trunk without losing production from the plant.

Tying

Use a material that will last the entire season. Binder twine or a lighter jute twine is satisfactory. Plastic covered wire ties used for plastic bags, etc. also could be used.

Tying should be done during relatively mild temperatures, but before buds have swollen or started growth. Canes that are very cold or frozen are brittle and easily broken. Such breakage is particularly likely when sharply bending the canes as required with the Umbrella Kniffin system. Buds that are quite swollen are easily broken off.

With the Four Cane Kniffin system, wrap the individual canes around the wire once or twice, depending on cane length, and tie just short of the last bud. Two wraps of twine with a firm double knot will hold a cane securely.

Terms

Some knowledge of grapevine parts is helpful in understanding pruning details. They are illustrated in Figure 3.

- **Trunk**
  This is the main permanent stem of the plant.
- **Shoots**
  Immature, soft stem growths of the current growing season are shoots. Shoots arise from buds on wood one or more years old and bear leaves, flowers and fruit.
- **Canes**
  These are the mature shoots, those which have become woody after growth has ceased. Fruiting cane merely refers to a 1-year-old cane that is capable and suitable for bearing fruit.
- **Arms**
  These might be called temporary side extensions of the main stem. They are the basal portions of former canes that were left after pruning.
- **Spurs or renewal spurs**
  These are 1-year-old canes (preferably originating near the trunk) shortened to two buds. Shoots (and later canes) develop from the spur buds. One of these is selected as a fruiting cane for the following season, thus "renewing" the fruiting wood.
- **Sucker**
  This shoot (or cane) usually arises from the lower part of the trunk.

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